

FIG. 1
(PRIOR ART)

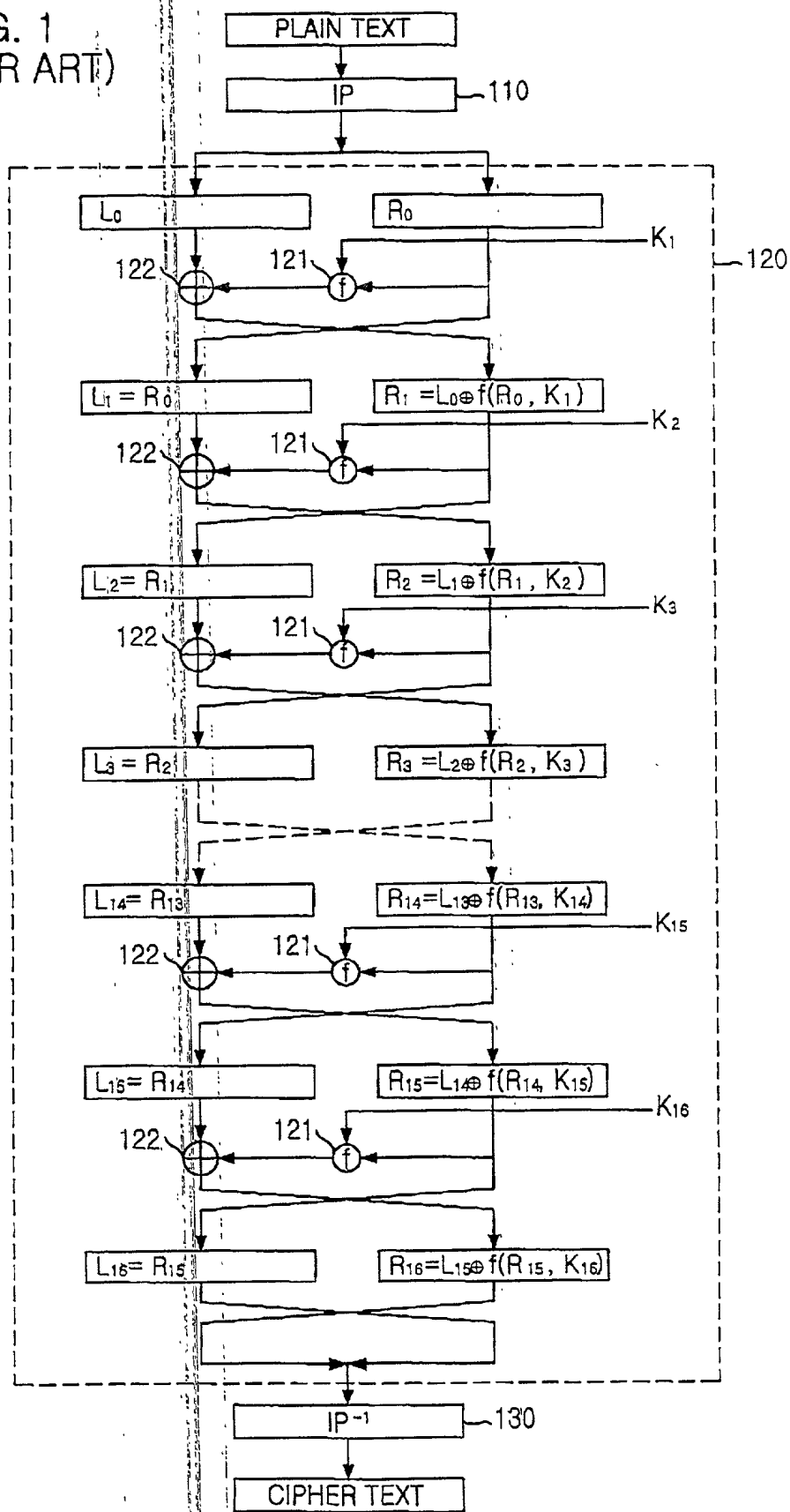


FIG. 2
(PRIOR ART)

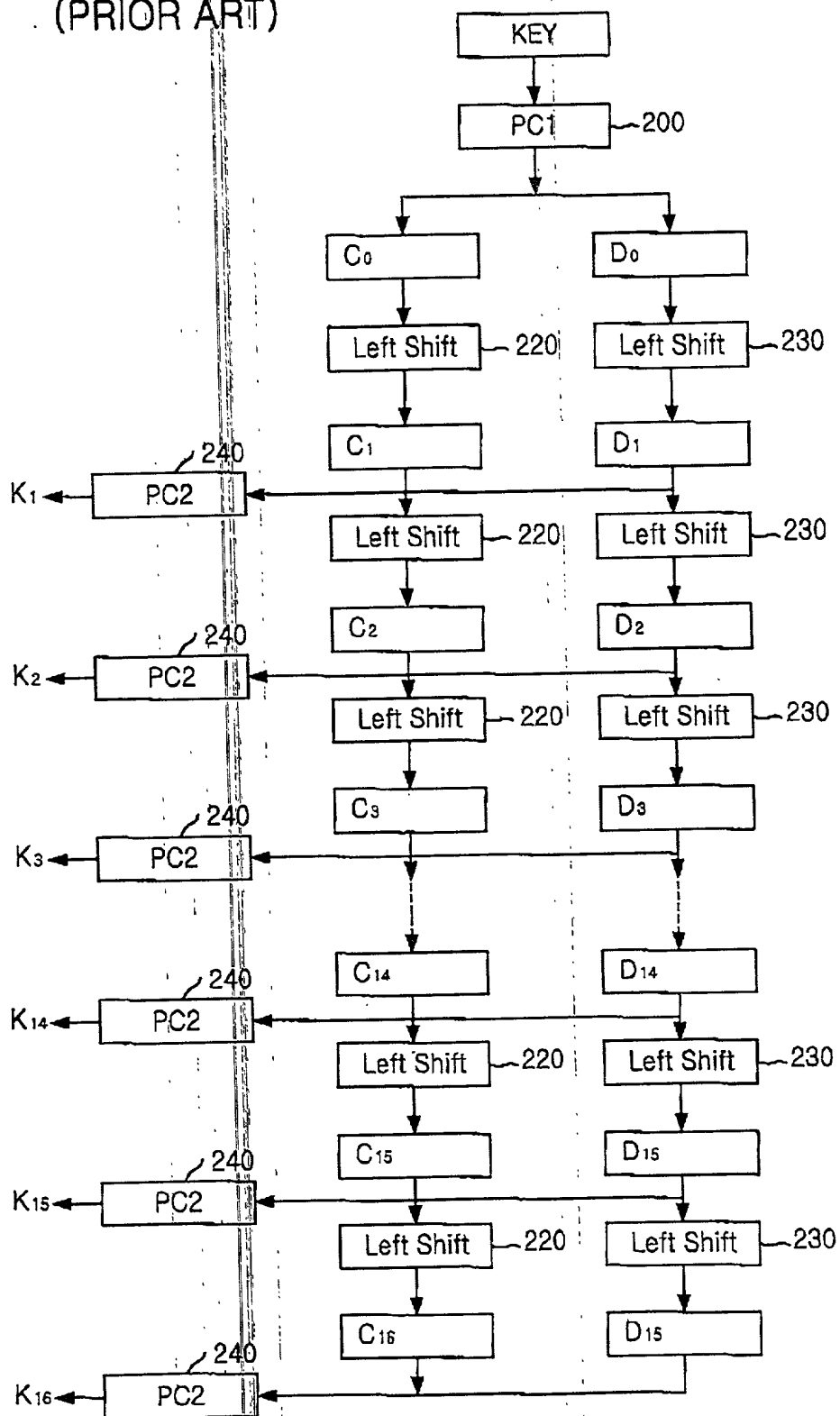


FIG. 3
(PRIOR ART)

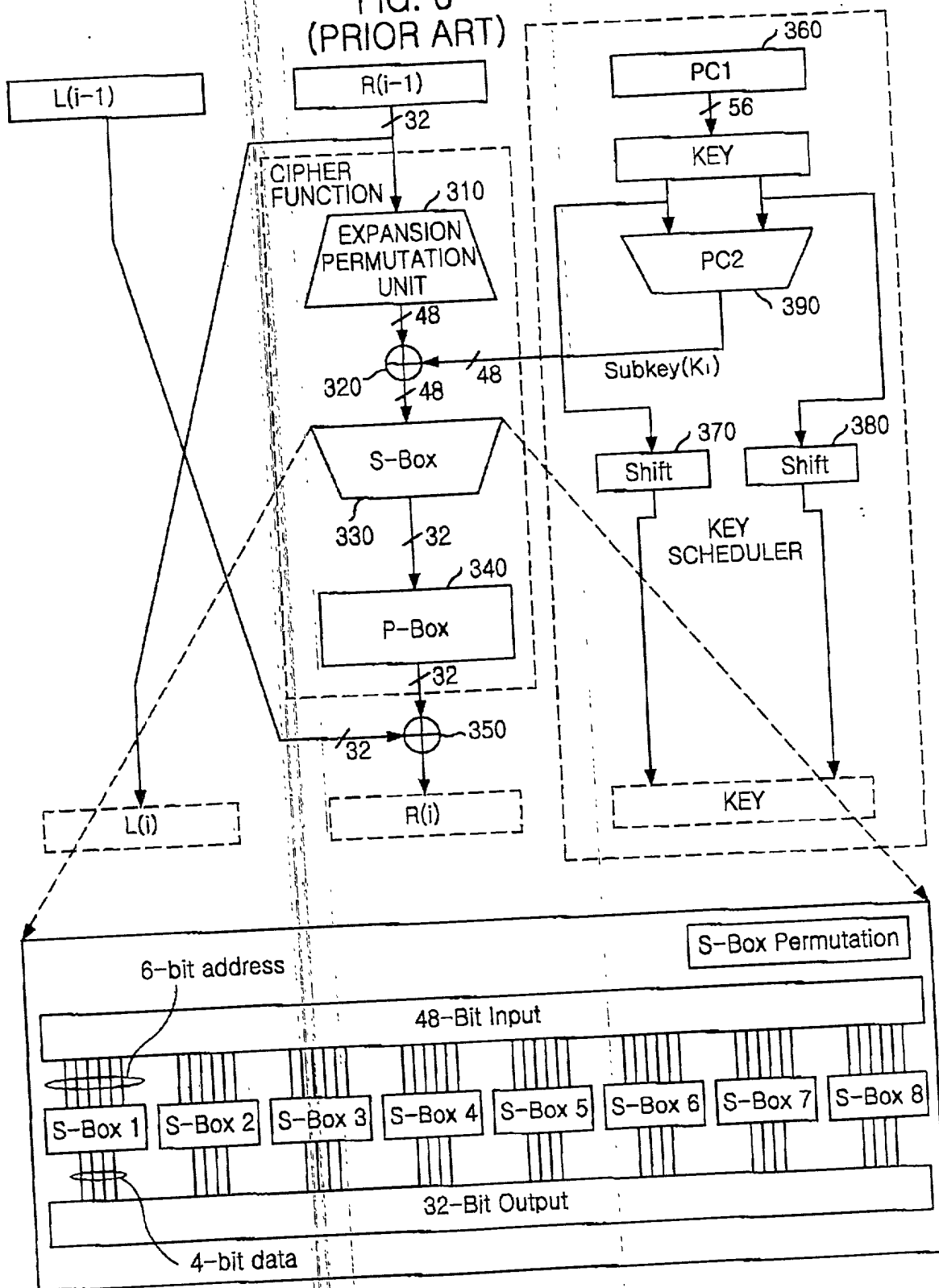


FIG. 4
(PRIOR ART)

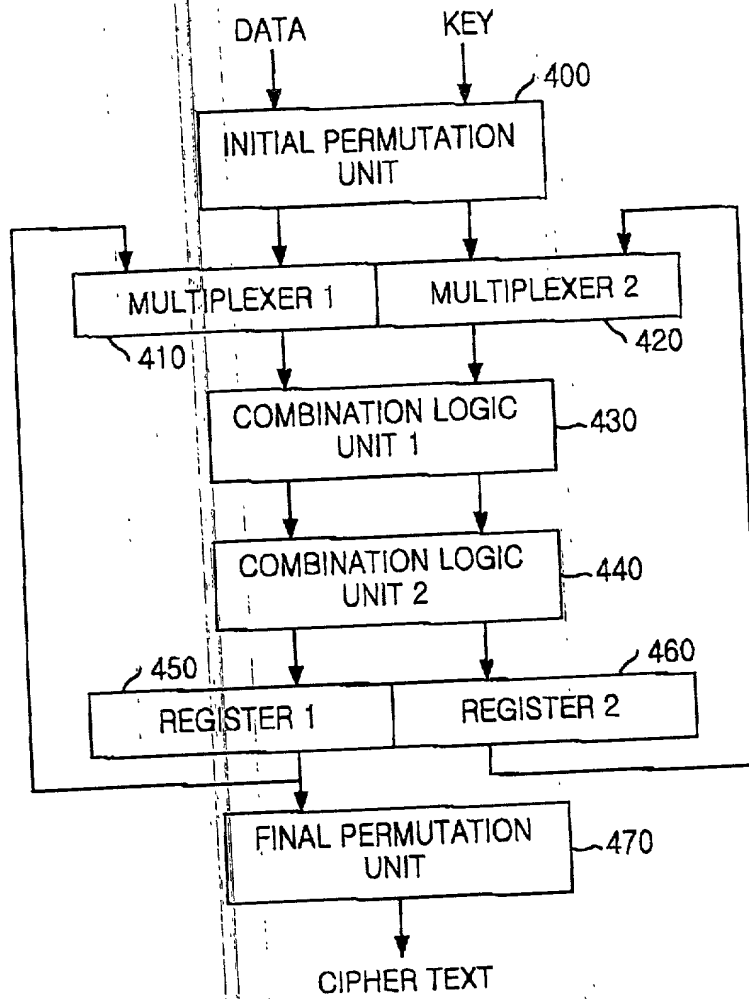


FIG. 5A
(PRIOR ART)

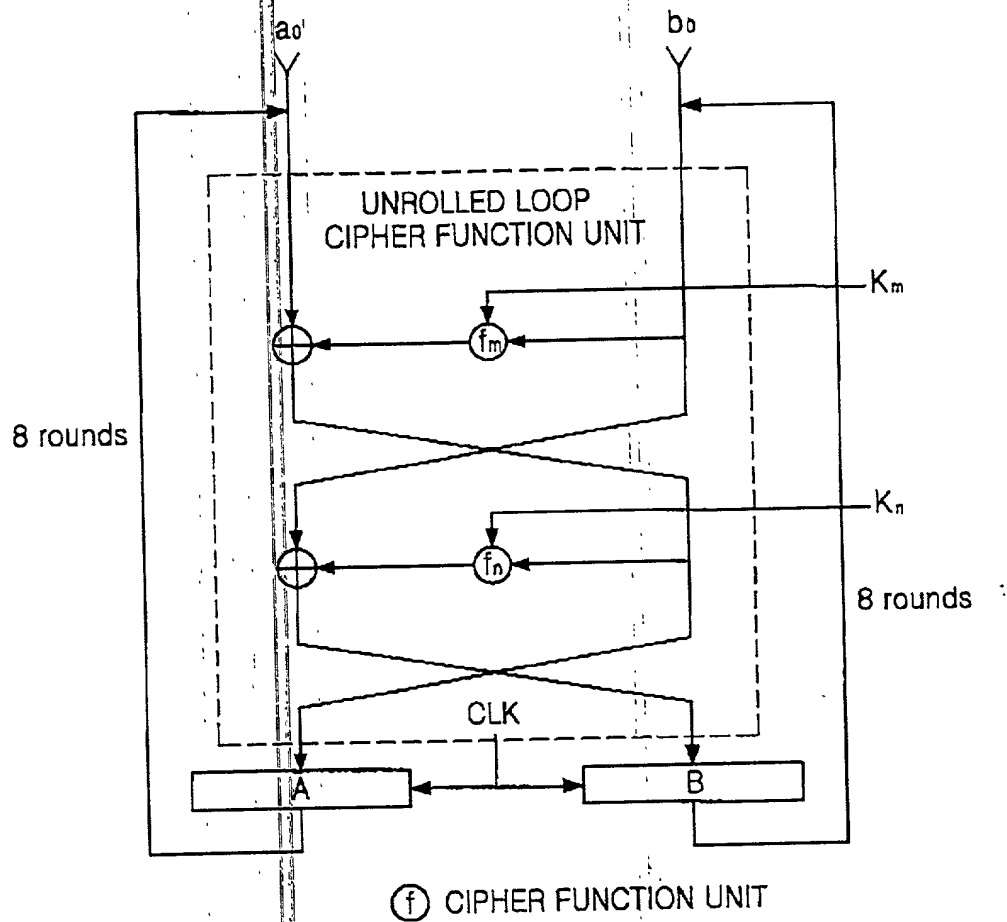


FIG. 5B
(PRIOR ART)

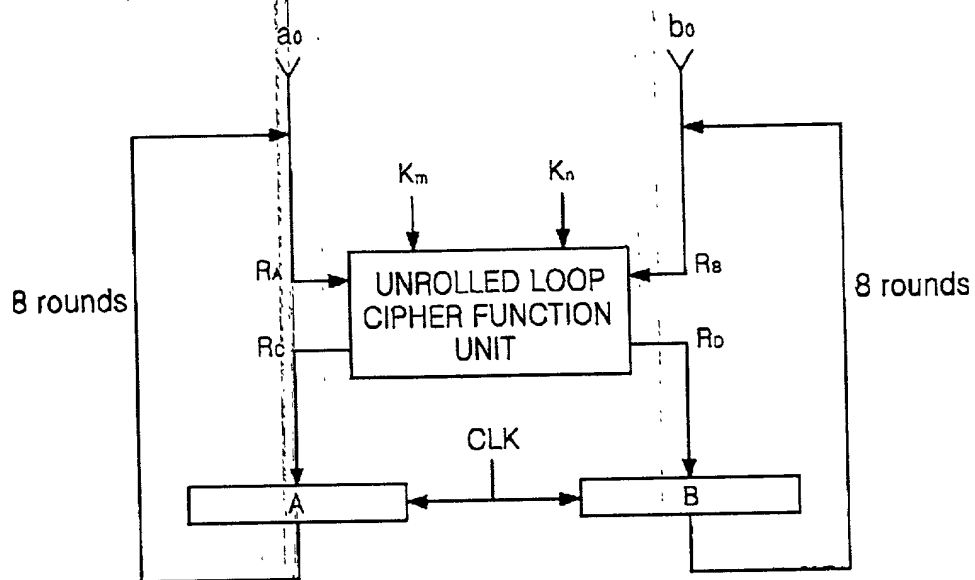


FIG. 6
(PRIOR ART)

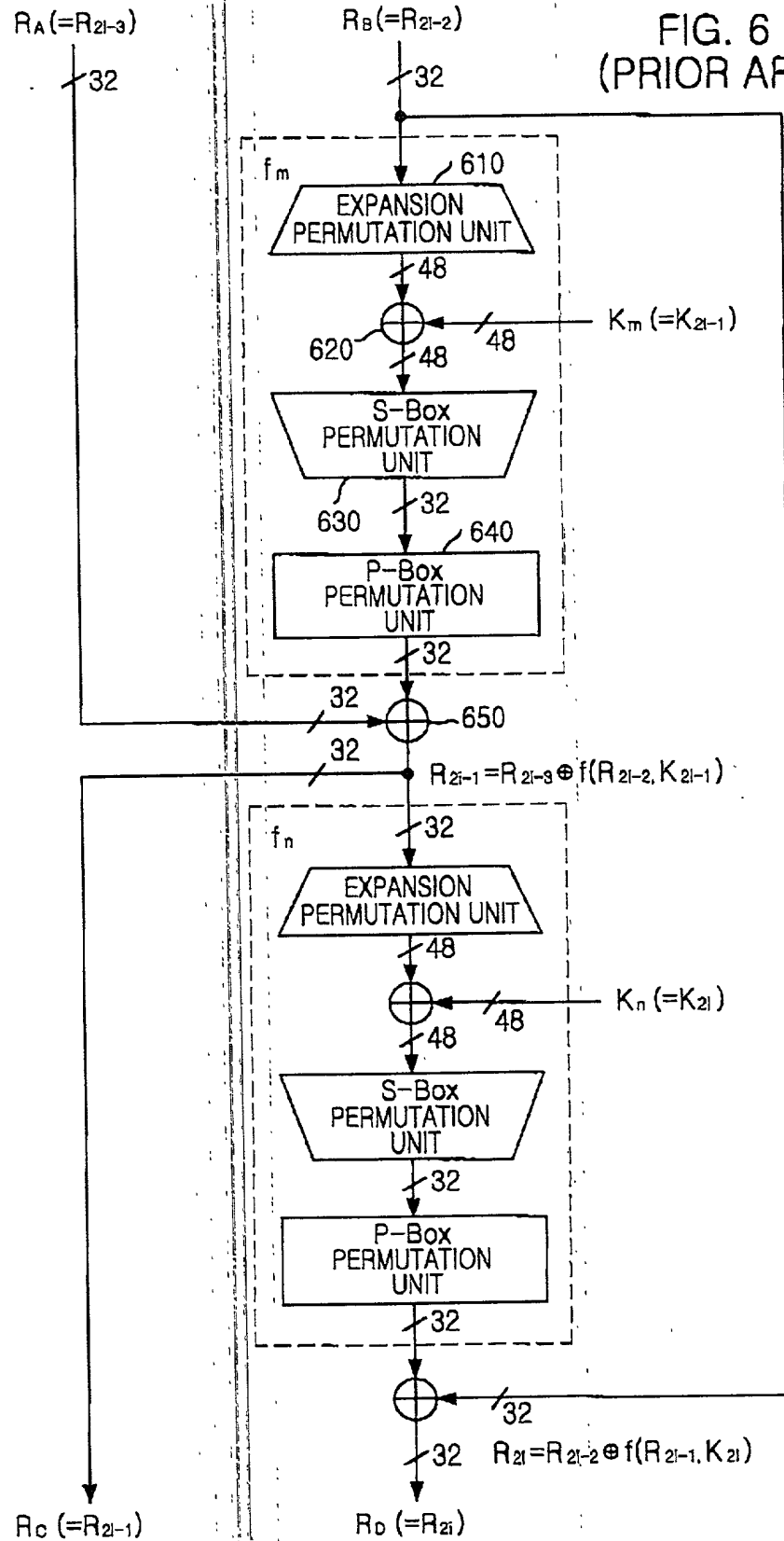


FIG. 7
(PRIOR ART)

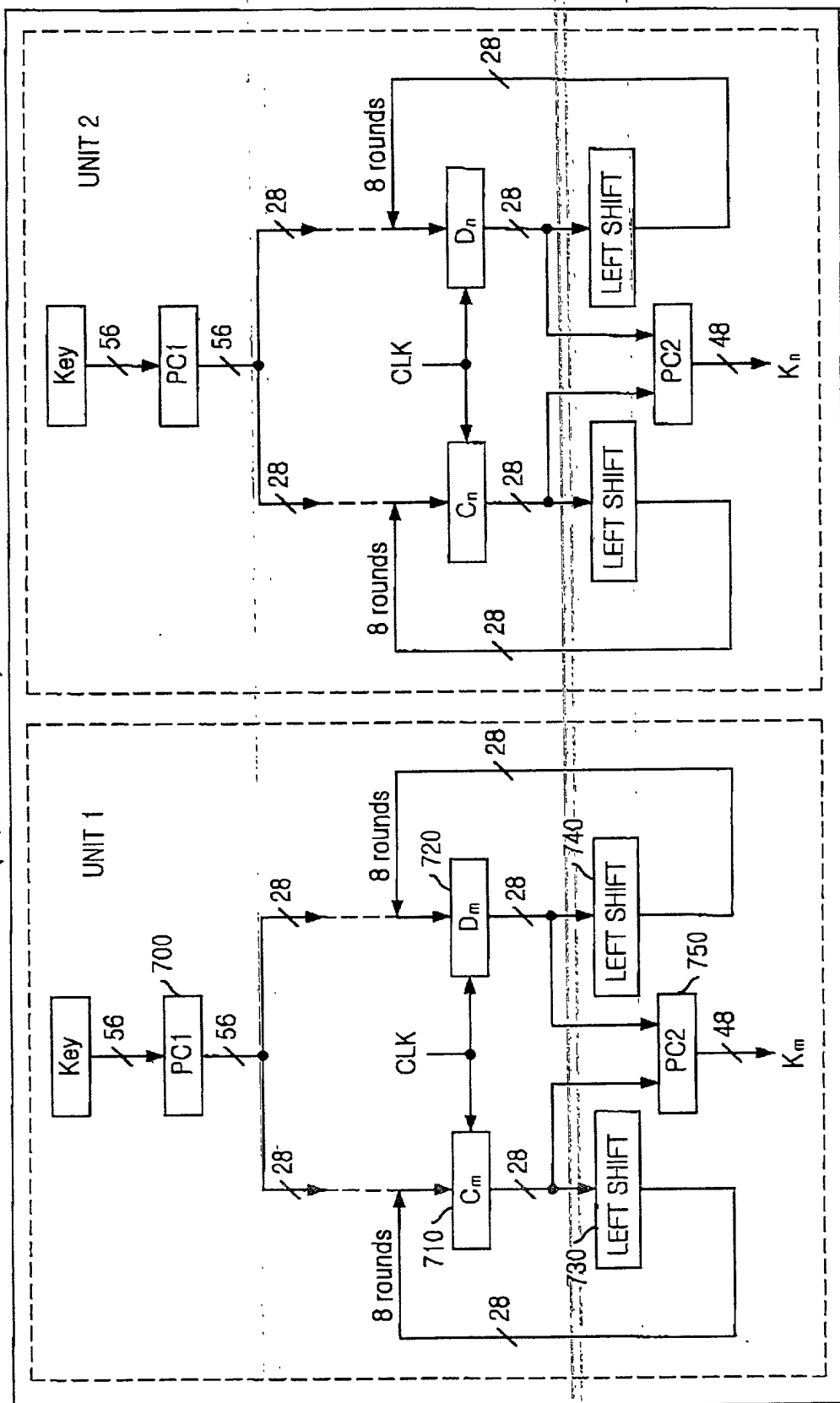


FIG. 8

Round	S_m	TS_m	D_m	TS_n
1(P_0)	3	1	+1	2
2(P_1)	4	4	+2	6
3(P_2)	4	8	+2	10
4(P_3)	3	12	+2	14
5(P_4)	4	15	+2	17
6(P_5)	4	19	+2	21
7(P_6)	4	23	+2	25
8(P_7)	2*(1)	27	+1(0)	0

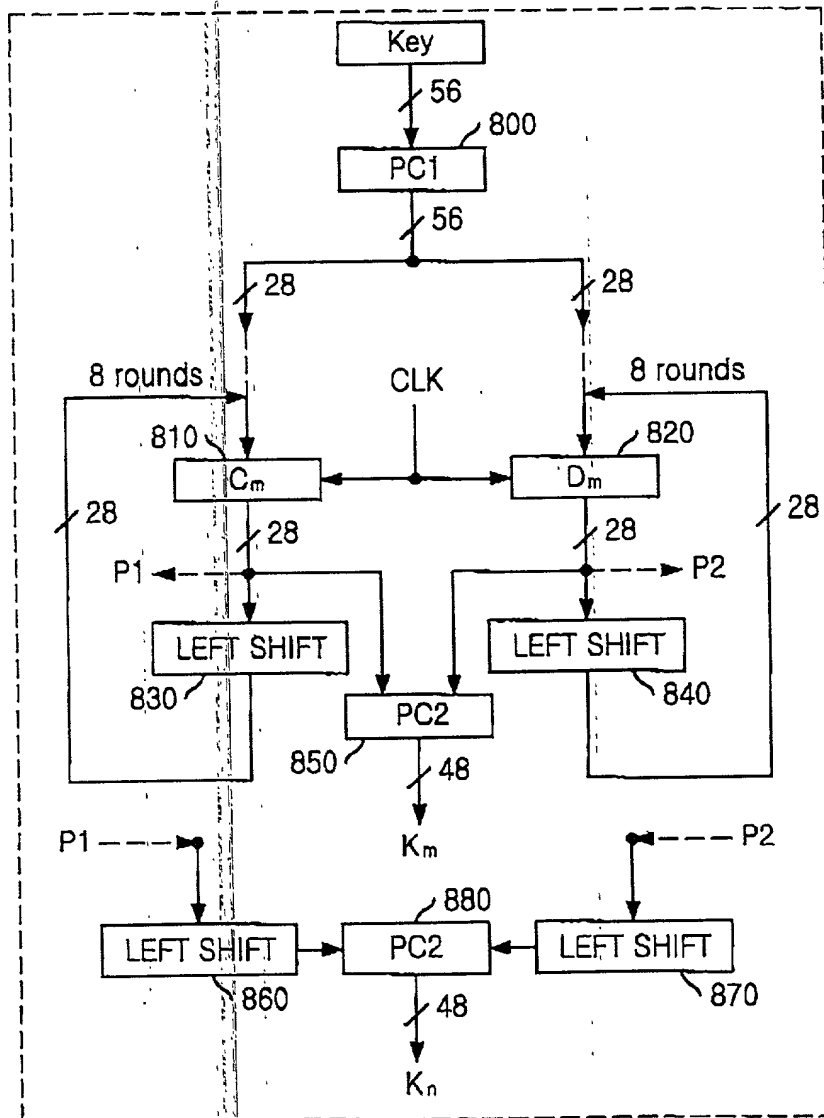
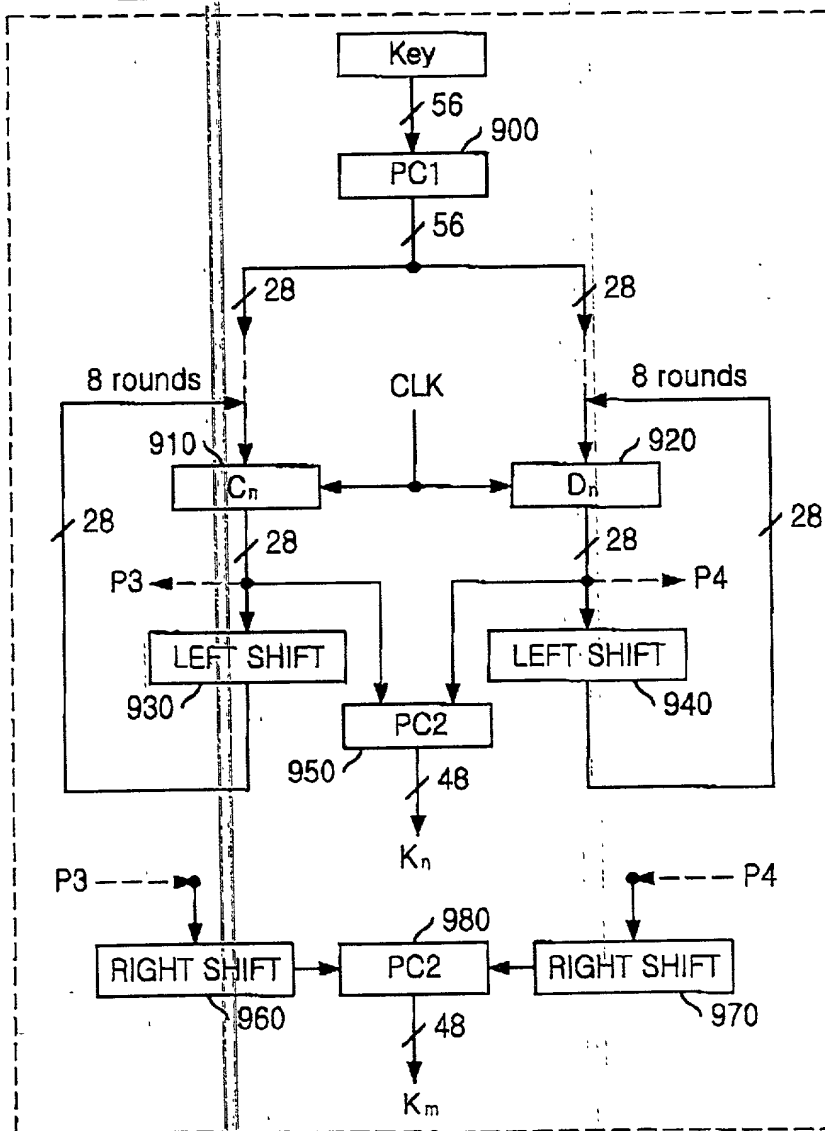


FIG. 9

Round	S_n	TS_n	D_n	TS_m
1(P_0)	4	2	-1	1
2(P_1)	4	6	-2	4
3(P_2)	4	10	-2	8
4(P_3)	3	14	-2	12
5(P_4)	4	17	-2	15
6(P_5)	4	21	-2	19
7(P_6)	3	25	-2	23
8(P_7)	2	0	-1	27



	0.8	1.6	3.2	6.4	12.8	25.6	51.2	102.4	204.8	409.6	819.2	1638.4	3276.8	6553.6	13107.2	26214.4	52428.8	104857.6	209715.2	419430.4	838860.8	1677721.6	3355443.2	6710886.4	13421772.8	26843545.6	53687091.2	107374182.4	214748364.8	429496729.6	858993459.2	1717986918.4	3435973836.8	6871947673.6	13743895347.2	27487790694.4	54975581388.8	109951162777.6	219902325555.2	439804651110.4	879609302220.8	1759218604441.6	3518437208883.2	7036874417766.4	14073748835532.8	28147497671065.6	56294995342131.2	112589990684262.4	225179981368524.8	450359962737049.6	900719925474099.2	1801439850948198.4	3602879701896396.8	7205759403792793.6	14411518807585587.2	28823037615171174.4	57646075230342348.8	115292150460684697.6	230584300921369395.2	461168601842738790.4	922337203685477580.8	1844674407370955161.6	3689348814741910323.2	7378697629483820646.4	14757395258967641292.8	29514790517935282585.6	59029581035870565171.2	118059162071741130342.4	236118324143482260684.8	472236648286964521369.6	944473296573929042739.2	1888946593147858085478.4	3777893186295716170956.8	7555786372591432341913.6	15111572745182864683827.2	30223145490365729367654.4	60446290980731458735308.8	120892581961462917470617.6	241785163922925834941235.2	483570327845851669882470.4	967140655691703339764940.8	1934281311383406679529881.6	3868562622766813359059763.2	7737125245533626718119526.4	15474250491067253436239052.8	30948500982134506872478105.6	61897001964269013744956211.2	123794003928538027489912422.4	247588007857076054979824844.8	495176015714152109959649689.6	990352031428304219919299379.2	1980704062856608439838598758.4	3961408125713216879677197516.8	7922816251426433759354395033.6	15845632502852867518708790067.2	31691265005705735037417580134.4	63382530011411470074835160268.8	126765060022822940149670320537.6	253530120045645880299340641075.2	507060240091291760598681282150.4	1014120480182583521197362564300.8	2028240960365167042394725128601.6	4056481920730334084789450257203.2	8112963841460668169578900514406.4	16225927682921336339157801028812.8	32451855365842672678315602057625.6	64903710731685345356631204115251.2	129807421463370690713262408230502.4	259614842926741381426524816461004.8	519229685853482762853049632922009.6	1038459371706965525706099265844019.2	2076918743413931051412198531688038.4	4153837486827862102824397063376076.8	8307674973655724205648794126752153.6	16615349947311448411297588253504307.2	33230699894622896822595176507008614.4	66461399789245793645190353014017228.8	132922799578491587290380706028034457.6	265845599156983174580761412056068915.2	531691198313966349161522824112137830.4	1063382396627932698323045648224275660.8	2126764793255865396646091296448551321.6	4253529586511730793292182592897102643.2	8507059173023461586584365185794205286.4	17014118346046923173168730371588410572.8	34028236692093846346337460743176821145.6	68056473384187692692674921486353642291.2	136112946768375385385349842972707284582.4	272225893536750770770699685945414569164.8	544451787073501541541399371890829138329.6	1088903574147003083082798743781658276659.2	2177807148294006166165597487563316553318.4	4355614296588012332331194975126633106636.8	8711228593176024664662389950253266213273.6	17422457186352049329324779900506532426547.2	34844914372704098658649559801013064853094.4	69689828745408197317299119602026129706188.8	139379657490816394634598239204052259412377.6	278759314981632789269196478408104518824755.2	557518629963265578538392956816209037649510.4	1115037259926531157076785913632418075299020.8	2230074519853062314153571827264836150598041.6	44601490397
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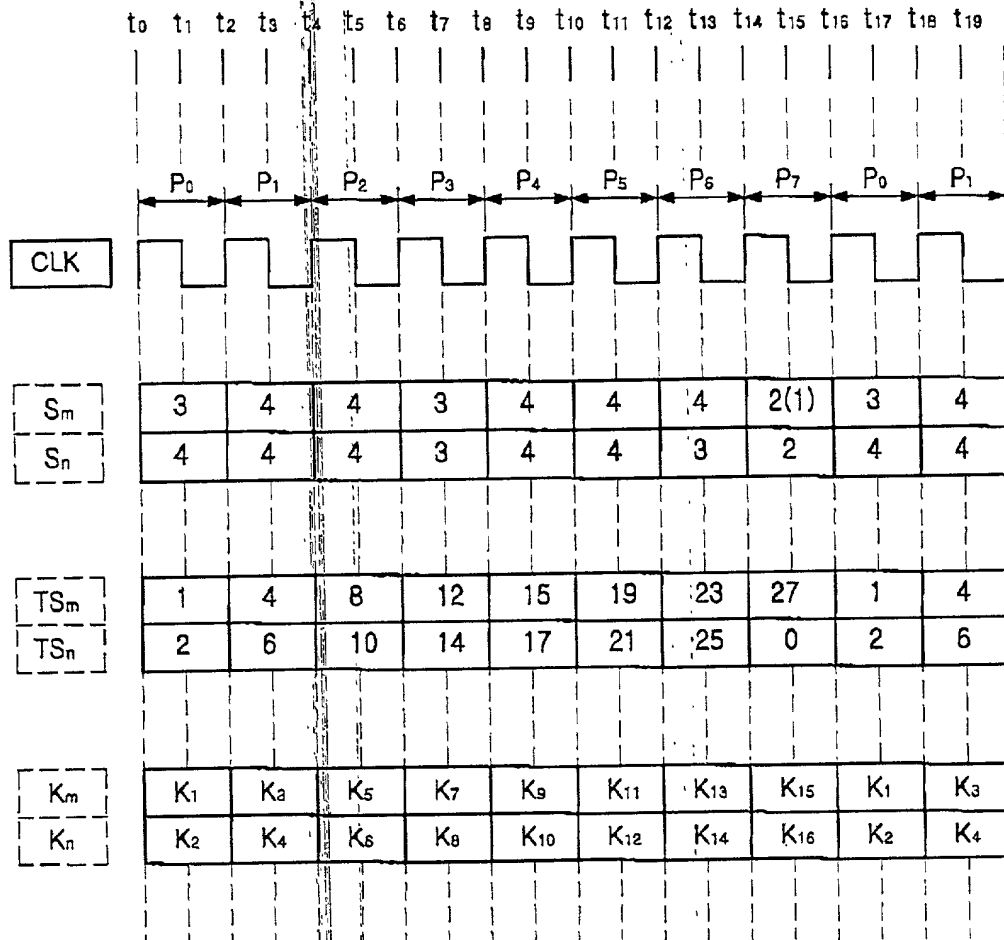


FIG. 11

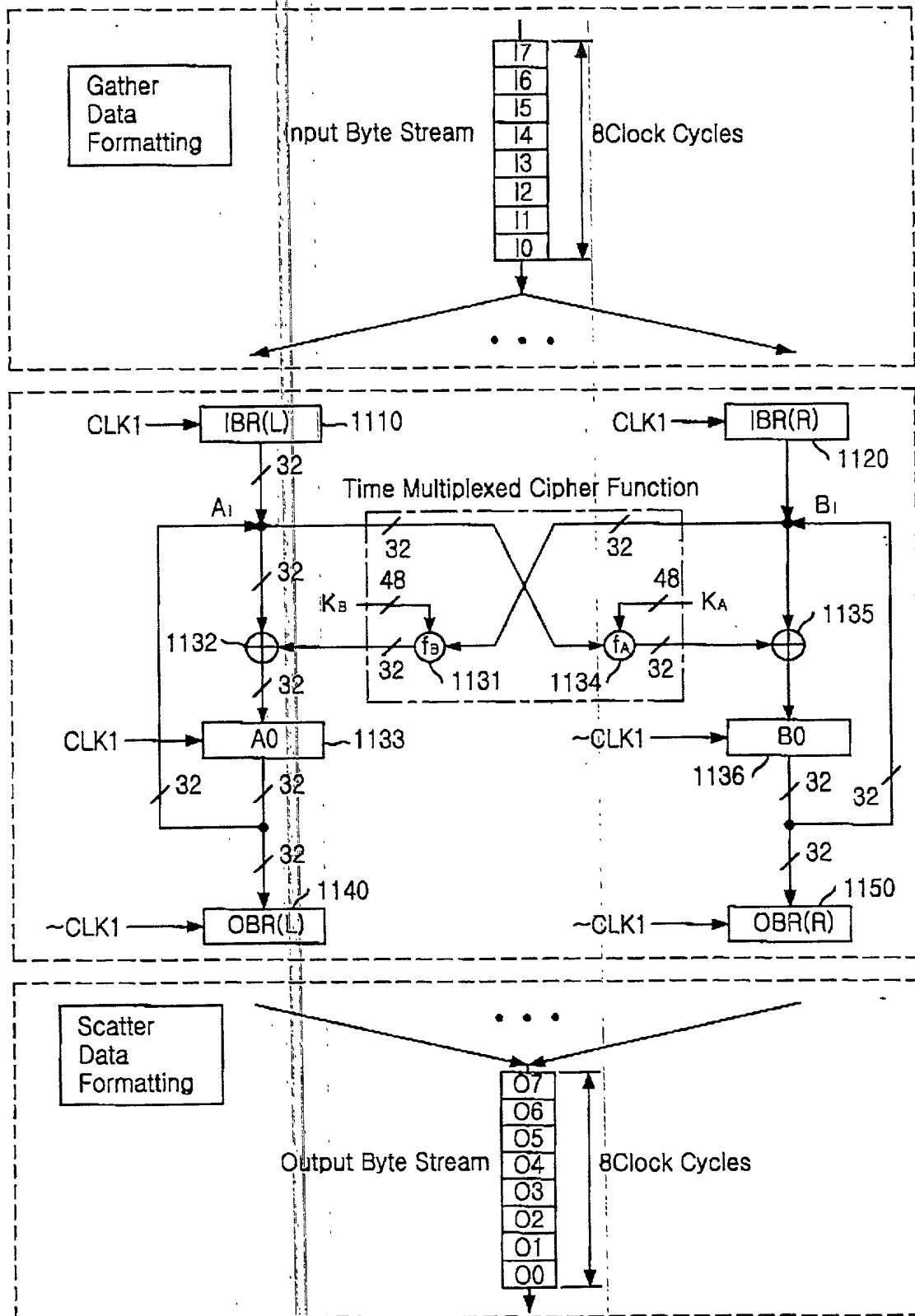


FIG. 12

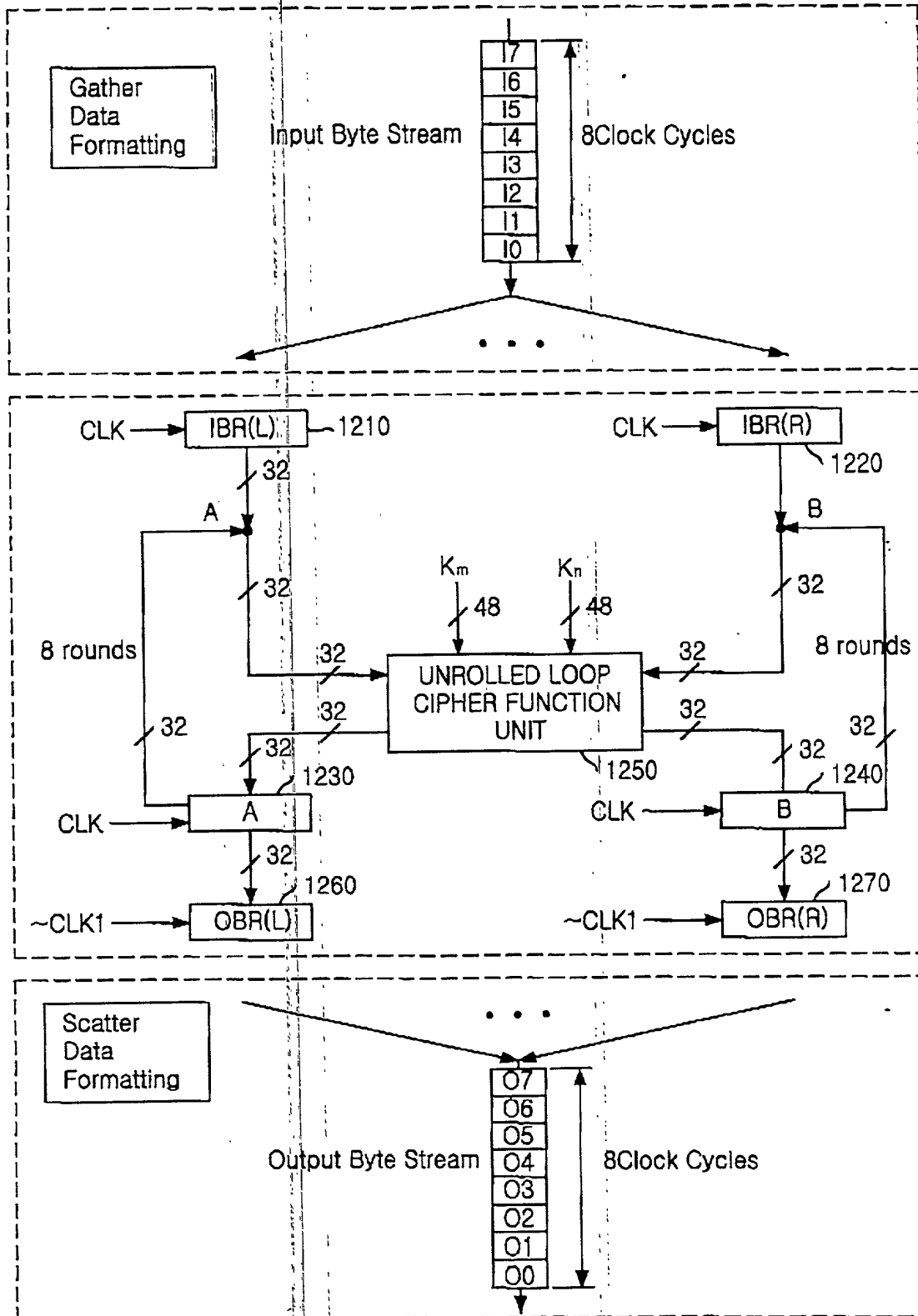


FIG. 13

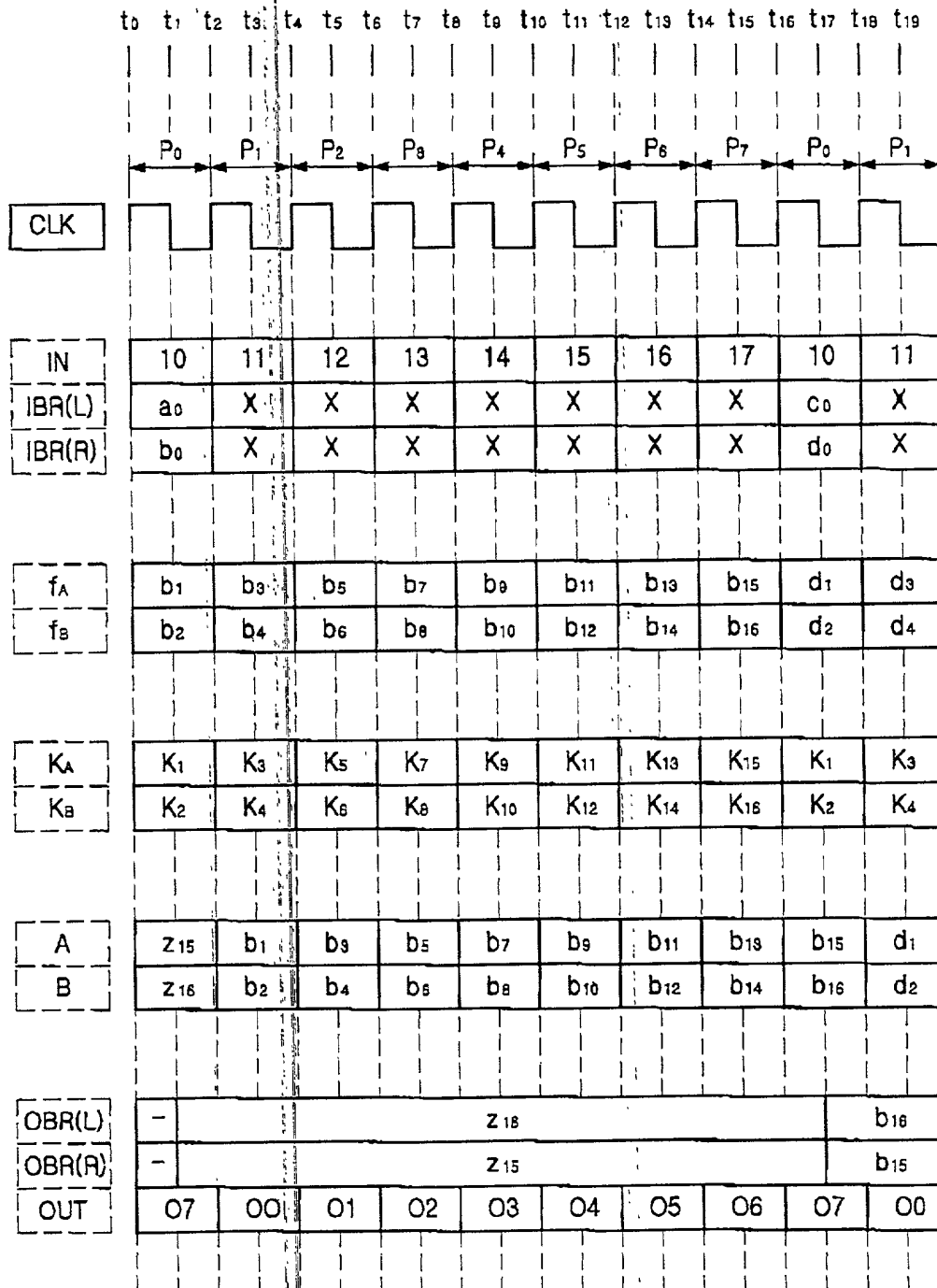
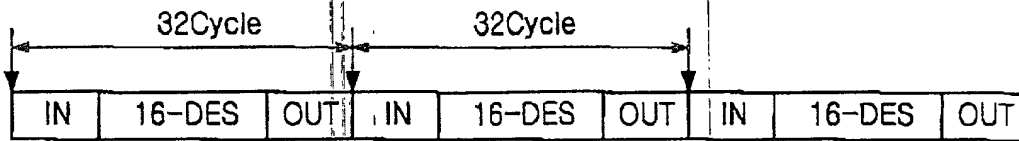


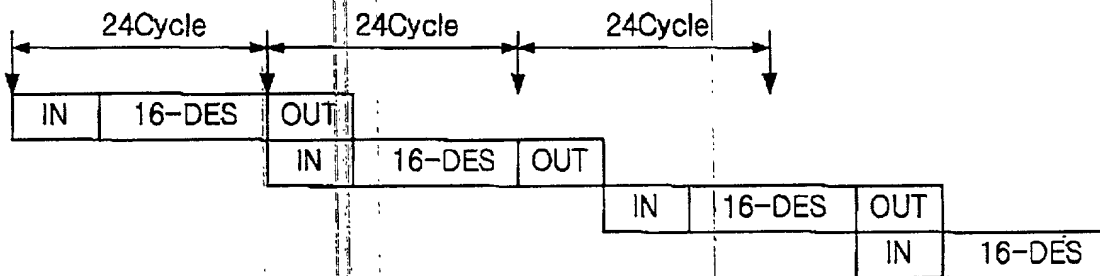
FIG. 14

Traditional 16 Round DES

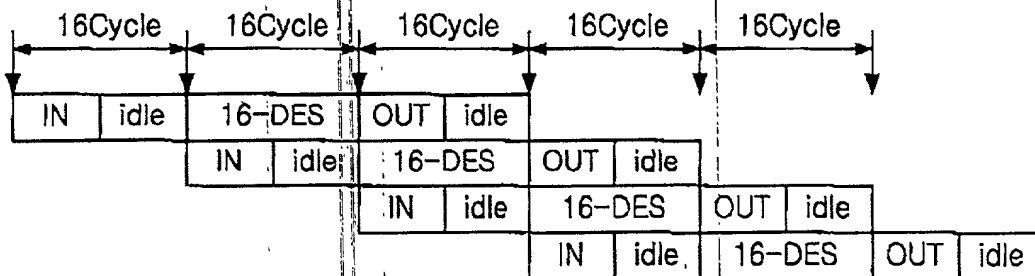
(1) No Latency Hiding (Latency=32, Throughput=1/32)



(2) 2-Stage Macro Pipeline (Latency=32, Throughput=1/24)



(3) 3-Stage Macro Pipeline (Latency=40, Throughput=1/16)



8Round DES (Loop Unrolled Cipher function & Time Multiplexed Cipher Function)

(4) 3-Stage Macro Pipeline (Latency=24, Throughput=1/8)

